First, I have the honour of laying before the Academy some photographs taken by the well-known method indicated by Röntgen; for, besides being excellent photographs, they show some new features. The photographs are:—

(1) Those of various metals (magnesium, aluminium, iron, lead, zinc, copper, palladium, silver, gold, and platinum) photographed together on the same plate. They confirm the relation found by Röntgen between the transparency and density.

(2) Photographs of the same metals, and further a *scale of transparency*, obtained by photographing the shadow of a thin rectangular slab of aluminium having one side tapered. These photographs are those I took in seeking for a possible colour-effect, placing between the Crookes' tube and the metal sheets various substances, such as cardboard, aluminium, sheets of gold and silver, &c. In spite of these being interposed, the photographs, when compared with the scale of transparency, show the same relative intensity.

(3) A photograph of the shadow of my hand. This kind of picture shows, as is well known, the bones, and not only the phalanges of the fingers but also the whole metacarpus is seen. It is noticeable that the cartilages are far less transparent than they appear in the pictures published in the journals, and, on the contrary, *the spongy parts of the phalanges are more transparent.*

(4) A photograph of the shadow of the œdematous hand of a corpse (that of a woman aged fifty-nine); in the second phalange of the index-finger was fixed an iron nail; that of the middle finger was broken by a hammer; in that of the third was introduced a small drop of mercury; finally, the palm of the hand was pierced with a needle, which was entirely hidden in the flesh. In the photograph these details are all clearly shown. Besides all the phalanges of the fingers and the metacarpus, which are clearly visible with all the joints, the carpus can just be distinguished. Here also may be noticed that the cartilages are not very transparent, *and the spongy parts of the phalanges show up well.*

(5) A photograph of the same hand; besides the phalanges of the fingers and metacarpus may be seen *clearly defined the small bones of the carpus with their details, and further the portion photographed of the radius and the cubitus.* The peculiarities shown by the cartilages and spongy parts are repeated also in this example.

(6) Two photographs of an artifically paralysed frog, *taken with very different exposures.* I would call attention to one point,—not hitherto noticed, as far as I know—which may interest this Academy of Medicine; in one of these photographs may be seen, besides the bone structure, the two lungs; in the other, *besides the lungs, the heart, and another internal organ, which I conclude is the spleen.* As might be expected, the lungs appear the more transparent.

I shall now relate the observations I have made by eye.

First I propose to consider the reason that the human eye is not directly sensitive to the Röntgen rays. *A priori* there is no impossibility in these rays exciting a luminous sensation. The phenomenon of persistence of vision with ordinary light may be attributed to a fluorescence of the retina or optical system of the eye. Now, Röntgen has found that to a certain extent bodies fluorescent to ordinary light are so also to his rays. Were this the case with the retina, it is obvious that the rays could give a luminous sensation, since they would produce actual light on the retina. With this idea I made some experiments on a retina taken from the eye of a living rabbit. Observations made with this living retina showed that, while somewhat fluorescent to the direct light issuing from a Crookes' tube, it gave no indication of fluorescence with the Röntgen rays. I should mention, however, that my two observations are not sufficient absolutely to exclude such a property from the living retina, as the phenomena shown by the Crookes' tube, with which I have hitherto worked, are not very intense.

I next examined photographically the transparency to Röntgen rays of the crystalline lens of the eye, and I obtained the result that the lens, together with the various media forming the optical system of the eye, intercept the rays to approximately the same extent a sa sheet of glass one millimetre thick; that is to say, *they are only slightly transparent.* Trials of the separate portions of the eye showed that the crystalline lens was the most opaque part, while the cornea was the most transparent. The conclusion I derive from these results is that, though the retina may be fluorescent to the Röntgen rays, as is the glass of the photographic plate, it is hardly probable that it could see objects directly through layers of wood, aluminium, flesh, &c. This, however, does not exclude the possibility of seeing them indirectly, by transforming, so to say, the Röntgen rays into ordinary luminous rays before they reach the eye. I have made a simple arrangement by means of which I can distinctly see the shapes of bodies enclosed in boxes of cardboard, aluminium, &c. This *cryptoscope*, which I have the honour of showing to the Academy, consists of a small cardboard tube about 8 centimetres high. One end is closed by a sheet of black paper, on which is spread a layer of fish-glue and calcium sulphide (there being no barium and platinum cyanide at hand); this substance I have found to be very phosphorescent under the action of Röntgen rays. Within the cardboard tube, at the other end, at which the eye is placed, is fixed a lens, giving a clear image of the phosphorescent paper. On looking through this *cryptoscope* one can see, even in a light room, the shape and position of metallic bodies enclosed in boxes of cardboard, wood, aluminium, and within the flesh. Its action is obvious; the fluorescent paper under the action of the rays is illuminated only in those portions which receive rays, consequently the silhouettes of the objects intercepting the rays appear dark. In this there is, of course, nothing new which could not have been deduced from the original experiments of Röntgen; the novelty, if indeed it is so, consists merely in making use of the known facts to design the arrangement. It seems to me that, in a more perfected form, it might be of extensive use in surgical and medical science. The sulphide of calcium may be replaced with advantage by the cyanide of barium and platinum. It is further clear that when, by a camera or other means, not only the shadows, but also the images, can be photographed (which, I believe, Profs. Battelli and Garbasso, of Pisa, have already succeeded in doing) the same *cryptoscope* will render visible also the images of bodies enclosed in boxes of wood or other materials.

As soon as possible I shall communicate the results of experiments I have begun with the view of shortening the necessary exposure by means of sensitive plates containing phosphorescent substances, or sensitive films backed by phosphorescent papers.

Finally, I wish to offer my warmest thanks to my honoured colleague G. Pisenti, Professor of Pathology, and Rector of the University, who has given me every possible assistance, and himself prepared the various portions of the eye with which I made the experiments.

THE LONDON CITY COMPANIES' GRANTS TO SCIENCE AND EDUCATION.

IT is well known that some of the London City Livery Companies make liberal grants for the purposes of education and research. In order to elicit information as to the extent and amount of such grants, we communicated a few months ago with the chief London Companies, and succeeded in obtaining several valuable statements. A few of the Companies sent us complete accounts of what they have done and are doing for the promotion of education and scientific investigation, but others only gave information concerning some of the grants made. The facts which follow do not, therefore, represent a complete statement of the assistance rendered by the Livery Companies, but they will serve to show the extent of the gifts. The Companies are mentioned in the order of civic precedence.

The Grocers' Company, in addition to making large annual grants for general educational purposes, established in 1883, and still maintain, three scholarships of the value of £250 a year for the encouragement of original research in sanitary science. Among the names of those who have held these scholarships are Dr. Wooldridge, Dr. Woodhead, and Dr. MacFadyen. Further, in 1894, the Company gave the sum of £10,000 to the British Institute of Preventive Medicine.

It is almost impossible to give an adequate idea of the educational work done by the Drapers' Company. For several years the Company have been deeply impressed with the importance of encouraging education, and especially of assisting clever children among the poorer classes to obtain higher education. With this view they established in the year 1875, and have annually given since that date, five scholarships, each of the value of £30 per annum, and tenable for four years at places of education higher than elementary. These scholarships are offered for competition by boys and girls attending metropolitan public elementary schools. In the year 1889, the Company further established fifty scholarships tenable at the Company's school at Woodford in Essex, a first grade modern school, and offered them for competition by boys attending metropolitan public elementary schools. They co-operated in the conversion of one of their charities, now known as the Sir Wm. Bowman's Foundation, Greenwich, by means of which one hundred boys, selected by competition from public elementary schools in Greenwich, are now receiving gratuitously education in the Upper School of Greenwich Hospital. They have established scholarships in connection with the People's Palace Technical Day School, and some two hundred boys from metropolitan public elementary schools are now receiving gratuitous education there of a character to fit them to take their place as apprentices and improvers in workshops and manufactories. These scholarships are also offered for public competition.

In the year 1888 the Company, recognising the value of manual training as an adjunct to the general education of boys and girls, voted £1000 towards the cost of introducing and carrying on such training in metropolitan elementary schools for one year. The grant has annually been renewed since that date, and the manual classes are largely maintained by means of this grant. To places of higher education, both in London and the provinces, the Company have for many years past, and are still voting assistance. They established the spinning department of the Belfast Technical School; the engineering department of the University College of South Wales, Cardiff; the coal-mining department of the Yorkshire College of Science, Leeds; and they were the principal contributors to the establishment of the department of technical education in the University College of Nottingham. They have also made large grants for buildings and apparatus to many other educational institutions. During the year 1892, they expended no less than £26,000 in the promotion of education.

Since 1893, the Drapers' Company have very largely extended the educational work of the People's Palace; in fact, they have contributed about £100,000 to that institution. They have also increased their grants to the various provincial institutions mentioned in the foregoing, and assisted several others. Their School Board scholarships have been annually renewed, and they are maintaining their subscription of £1000 a year to the manual training classes in London elementary schools. About two years ago they established six scholarships with the view to enabling certain selected pupil-teachers from elementary schools to proceed to one of the universities. This scheme is working successfully, and will no doubt be developed. At present the Company are subscribing £400 to £500 per annum for these scholarships. They are also contributing a somewhat similar amount for the apprenticeship of boys to handicraft trades. The foregoing refers to work done by the Company in its corporate capacity. As trustees, they administer several important educational and apprenticeship endowments, and for the most part free of all expense to the charity.

The Fishmongers' Company have contributed a total sum of £68,760 to the City and Guilds Institute, £525 to the Borough Road Polytechnic, £340 to the North London Polytechnic, £52 10*s*. to the Wandsworth Technical Institute, £210 to the Baltimore Fishery School, £4300 to the Marine Biological Association, Plymouth, and £105 to the British Institute of Preventive Medicine. They also grant a scholarship of £60 to a student of the Finsbury Technical College, to be held at the City and Guilds Institute. The Company also grant eighteen exhibitions of £40 each to students of the Universities, and four exhibitions of £20 each to Masters of Arts, four scholarships of £50 each to the City of London School, and four of £50 each to the Central Foundation Schools, besides the large sums expended in the inspection of fish and the protection of salmon.

The Goldsmiths' Company, unlike some of the other great Companies, have no educational trust; but they spend a large proportion of their corporate funds upon technical, scientific, and general education. The Company was one of the first of the Companies to take up the subject of technical education, and they have been connected with the City and Guilds of London Institute from its inception; and to this Institute the Company have been the largest donors, their contributions to the present date exceeding £80,000, in addition to which they give an annual subscription of £4000. The Company have also, at their sole cost, established and endowed their Technical and Recreative Institute at New Cross. The capital expenditure upon the site, buildings, and equipment of this Institution amounts at this date to very little less than £100,000; and the Company have also assigned to it a minimum endowment of £6000 per annum. As regards general education, the Company have established seventy exhibitions of £50 per annum each for poor students at Oxford and Cambridge. These exhibitions are awarded solely for merit, coupled with a careful consideration of the pecuniary needs of the candidates. The Company also contribute to Newnham and Girton Colleges for poor lady students; and they make considerable occasional grants to other educational Institutions. A short time ago the Company granted £1000 to the Royal Institution, for the furtherance of Prof. Dewar's researches at low temperatures; and £1000 to the Imperial Institute, for research work in connection with Indian and Colonial products; and they have also recently given £1000 for the prosecution of research work in connection with the anti-toxin treatment of diphtheria. Altogether, a careful examination of the Company's expenditure during the past ten years shows that during that period thirty per cent. of the *gross* corporate income of the Company has, on an average, been devoted to educational purposes, and, as above mentioned, all this expenditure is made out of the Company's private funds.

The Skinners' Company give £2000 per annum to the City and Guilds Institute and contribute towards the support of the Northampton Institute at Clerkenwell—the chief of the three members of the City group of Polytechnics. Many other grants have been made from time to time for educational and other purposes, scientific and recreative.

The Merchant Taylors' Company expend out of their corporate income between £7000 and £8000 a year on their school at Charterhouse Square, grant £2000 a year to the City and Guilds of London Institute, and make other grants of considerable sums for educational purposes, the total annual average expenditure on general education amounting to 28 per cent. of the net corporate income.

The Haberdashers' Company's donations and grants are, we are informed, mainly devoted to general education; but no specific information has been furnished us with reference to them.

The Salters' Company have founded the following scholarships and Fellowships for the promotion of science, viz.:—£100 per annum to the Pharmaceutical Society of Great Britain for higher scientific research. £100 per annum to St. Thomas's Hospital for a like object. £150 per annum to the City and Guilds Institute for research in chemistry in its relation to manufactures (towards the general objects of which Institute the Company also subscribe nearly 1000 guineas per annum). The Company have founded Natural Science Exhibitions in connection with the City of London School and King's College School, London, which exhibitions are of the annual value of £80 each, as well as scholarships of lesser value at the Guildhall School of Music and the Royal Naval School, and, although perhaps not of a scientific nature, scholarships have been founded in connection with the Philological School in Marylebone Road, and Trent College, Nottingham. In addition to the above, the Company contribute to many objects of acknowledged public utility, the amount of which contributions, in 1894, was some £5000.

The Clothworkers' Company have very generously contributed towards the advance of technical education in London and the provinces, as will be seen from the subjoined statement of grants. The Company have also established a research laboratory in connection with the Clothworkers' Textile, Dyeing, and Design Departments of the Yorkshire College, Leeds. Numerous papers descriptive of work done in this laboratory have been contributed to the Chemical Society and the Society of Chemical Industry. The Company's grants to scientific institutions in London are:—City and Guilds of London Institute (£3500 per annum), £68,250; Imperial Institute, £2500; King's College (Scholarships not exceeding £225 per annum), £2000; King's College (Kensington Branch for the Higher Education of Women), £500; University College (Scholarships, £60 per annum), £650; Northern (Islington) Polytechnic, £17,500; People's Palace Polytechnic, £1000; Borough Road Polytechnic, £1000; Regent Street Polytechnic, £500; South-Western Polytechnic, £100; Finsbury Polytechnic, £100; North-West London Polytechnic, £50; City of London College, £600; Birkbeck Institution, £205; Marine Biological Association, £500; British Institute of Preventive Medicine, £100; London Society for

Extension of University Teaching, £1100; Middle-Class Schools Corporation (now Central Foundation Schools of London), £2500; National Association for Promotion of Technical Education, £150; Bedford College (Physical and Chemical Laboratories), £125; Toynbee Hall, Whitechapel, £125; Society of Arts, £504; Royal Architectural Museum and School of Art, £142; Bethnal Green Free Library, £141; Recreative Evening Schools Association, £340; Froebel Educational Institute, £100; Parmiter Foundation School, £100; University Settlement, Bermondsey, £25; Palæontographical Society, £21; Onslow College of Science, £250—making a total of £101,178. To scientific institutions in the provinces the grants for building equipment and general purposes amount to:—Yorkshire College, Leeds (textile industries, dyeing, and art departments, wholly founded and maintained by the Company), £34,000; Bradford Technical College, £4350; Huddersfield Technical School, £2000; Halifax Technical School, £2100; Keighley Technical School, £1300; Dewsbury Technical School, £825; Salt Science and Art Technical School, Shipley, £825; Bingley Technical School, £350; Batley Technical School, £250; Holmfirth Technical School, £250; Ossett Technical School, £200; Wakefield Technical School, £100. In addition to this, the Company grant to these institutions annually for maintenance a sum amounting to about £4000.

It is interesting to compare with the grants named in the foregoing, the estimate which the Technical Education Board of the London County Council have just submitted to the Finance Committee of the Council, as to the sum required by them for the year ending March 31, 1897. The net probable expenditure will amount to £120,000, of which £9000 is for the equipment and £16,000 the maintenance of technical departments of polytechnics. The other items are £9680 for Shoreditch, Wandsworth, and other technical schools, £20,000 for technical departments of public secondary day schools (including allowance for the fees of the Board's county scholars £70,500), £4000 for higher education, £26,070 for county scholarships, £14,440 for art teaching (including art scholarships), £8985 for science teaching (including science exhibitions and pioneer lectures, technology, and manual instruction), £4200 for domestic economy, £1500 for commercial subjects, £1000 for museums, and £5550 for expenses of administration (including cost of inspection). In 1893-94 the Board's expenditure was £46,000, in 1894-95 £63,000, and in 1895-96 £91,000. The chief causes of the increase are assigned to the development of the board's scholarship system, which has nearly reached its limit, and is costing nearly £40,000 per annum; the increase in the amount of evening educational work carried on in accordance with the Board's regulations, and therefore eligible for the Board's grants; the very great increase in the number of students who are studying science practically, as shown by the recent report of the Board's science inspector, and the consequent expenditure incurred in equipping and maintaining laboratories; the opening of new polytechnics, and the development of the technical departments of other polytechnics, and the establishment of new institutions.

In one respect the Livery Companies are in advance of the Technical Education Board, and that is in the encouragement given to research. The funds of the Technical Education Board are used to create and foster classes and institutions concerned with technical instruction, and probably the Board does not feel at liberty to give any direct assistance to research in the way that some of the Companies are doing. But, at the same time, the Board is doing work which should eventually result in an increase in the ranks of investigators, and it is to be hoped that the time is not far distant when the polytechnics will make those contributions to knowledge which are the only sure indications of scientific advancement.

ZOOLOGICAL NOMENCLATURE.

AT the meeting of the Zoological Society on Tuesday, Mr. P. L. Sclater, F.R.S., introduced a discussion on the following rules for the scientific naming of animals, compiled by the German Zoological Society.

A. GENERAL RULES.

(1) Zoological nomenclature includes extinct as well as recent animals, but has no relation to botanical names.

(2) Only such scientific names can be accepted as are published in print, in connection with a clear description either by words or figures.

(3) Scientific names must be in Latin.

(4) Names of the same origin and only differing from each other in the way they are written are to be considered identical.

(5) Alterations in names otherwise valid are only permitted in accordance with the requirements of Sections 13 and 22, and further for the purpose of purely orthographical correction when the word is without doubt wrongly written or incorrectly transcribed. Such alterations do not affect the authorship of the name.

(6) Of the various permissible names for the same conception only the one first published is valid (Law of Priority).

(7) The application of the Law of Priority begins with the tenth edition of Linnæus's "Systema Naturæ" (1758).

(8) When by subsequent authors a systematic conception is extended or reduced, the original name is nevertheless to be regarded as permissible.

(9) The author of a scientific name is he who has first proposed it in a permissible form. If the author's name is not known, the title of the publication must take its place.

(10) If the name of the author is given it should follow the scientific name without intervening sign. In all cases in which a second author's name is used a comma should be placed before it.

(11) Class (*classis*), Order (*ordo*), Family (*familia*), Genus (*genus*), and Species (*species*) are conceptions descending in rank one after the other, and are to be taken in the order here given. These terms should not be employed in a contrary or capricious relation of order.

B. RULES FOR DESIGNATING SPECIES.

(12) Every species should be designated by one generic and one specific name (binary nomenclature).

(13) The specific name, which should be treated always as one word, should depend grammatically upon the generic name.

(14) The same specific name can only be used once in the same genus.

(15) In the case of a species being subdivided, the original name is to be retained for the species which contains the form originally described. In doubtful cases the decision of the author who makes the separation shall be followed.

(16) When various names are proposed for the same species nearly at the same date, so that the priority cannot be ascertained, the decision of the first author that points out the synonym should be followed.

(17) In the case of species with a cycle of generation of different forms, the specific term must be taken from an adult form capable of reproduction. In these cases, as also in species in which polymorphy occurs, the Law of Priority must be observed.

(18) The author of the specific name is the author of the species.

(19) The author's name should be placed in brackets when the original generic name is replaced by another.

(20) Hybrids should be designated either by a horizontal cross between the parents' names, or by these names being placed one above the other with a line between. The parents' sexes should be stated, when known. The name of the describer of the hybrid should be added, preceded by a comma.

C. RULES FOR THE NAMES OF SUBSPECIES AND OTHER DIVERGENCES FROM TYPICAL SPECIES OR SUBSPECIES.

(21) When constant local forms, varieties, strains, &c., require special names, these names should be placed after the specific name. The rules for such names are the same as those for specific names.

D. RULES FOR GENERIC NAMES.

(22) Names of genera should be substantives, and of the singular number. They should be one word and be written with a large initial letter. If a subgenus is used, its name (which follows the same rules as a generic name) should be given in brackets after the generic name.

(23) A generic name is only valid when a known or a sufficiently characterised species (or several species) is referred to it, or when a sufficient diagnosis of it is given.

(24) The same generic name can only be employed once in